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RELEASING UNDERCUT MOULDED CONTAINERS AFTER A THERMOFORMING PROCESS

The invention relates to a device for forming a number of thin-walled objects by means of a blow-moulding process from a layer of material which is deformable when heated, comprising:

- a lower mould with cavities arranged therein, wherein the shape of each of the cavities corresponds with the external shape of the objects to be formed;
- means for carrying the layer of material to be moulded onto the lower mould;
- supply means for supplying gas to the upper side of the lower mould;
- heating means for heating the lower mould; and
- mandrels movable into the cavities.

Such devices are generally known. They are used to form products such as containers for coffee milk, yoghurt, salads and numerous other products by a blow-moulding process. Used as a starting point here is a thin layer of material which is deformable when heated and which is pushed fixedly into the cavity by means of compressed air, or pressurized air, is there cooled, whereby the shape is retained, and the completed product is then transported away.

The fact that product which is to a certain degree form-retaining must be removed from the mould imposes limitations in the prior art on the shape of the product.

There is however a need for more freedom in the choice of the shape of the product in order for instance to provide the product with additional functions.

The present invention therefore has for its object to provide such a device which is suitable for manufacturing shapes which in the prior art cannot be released from the mould.

This objective is achieved in that the lower mould is divided into a number of segments, wherein a number of segments is placed around each cavity and the segments are movable in substantially radial direction between a first position, in which they form the wall of the cavity enclosed by the segments, and a second position in which an object formed in the cavity can be moved out of the mould.

The mobility of the segments between a first position, in which the moulding process takes place, and a second position, in which the rigid product can be removed from the mould, results in a greater freedom in choosing the shape of the products for finishing.

It is herein noted that it is indeed known in injection mould production to use divisible moulds. Injection moulding is however a process wherein there is greater freedom and a much greater space is available for allowing movement of segments of the mould. In blow-moulding this is not the case; the blow-moulding process limits the mobility of the mould to a great extent; as a result of the process, blow-moulded products are manufactured adjacently of each other, i.e. all with their upper surface in the same plane, wherein the movements of the mould, which in the process in question is usually designated as lower mould, under the relevant plane are limited. It has therefore been assumed heretofore that it is impossible to provide a device for the blow-moulding process wherein the moulds are divisible for release of the finished product.

Certainly where small products are manufactured a blow mould will contain a relatively large number of cavities, so that the problem is made even more difficult.

According to another embodiment each cavity is enclosed by at least three segments wherein the separating planes between the segments extend substantially perpendicularly of the upper surface of the lower mould, and each of the segments is drivable for

movement between the first and second position by a drive member.

Geometric considerations indicate the attraction of this embodiment; the distance between the first and the second position of the segments is limited, while sufficient freedom for release of the mould is still obtained.

According to an attractive embodiment each cavity is enclosed by four segments, wherein each of the segments is drivable by a linear drive member. The use of four segments results in a structure of paths extending perpendicularly of each other, which is structurally attractive.

When the four segments, which are situated in closer proximity to each other in the second position than in the first position, are coupled to a common drive element, there is a resulting simplification since the number of drive elements is reduced.

According to a particularly attractive embodiment the common drive element is adapted to execute a movement in a direction perpendicular to the direction of movement of the segments, and the common drive element is connected to the four segments by means of a coupling converting the direction of movement.

This configuration is particularly attractive structurally; a common drive element can be used to cause a movement in four different directions.

An even more attractive embodiment results when the coupling comprises four prismatic pins, each extending at the same angle relative to the direction of movement of the drive element, and the segments each comprise a channel into which the pins fit and the axis of which corresponds with the axis of the pins.

Provided this construction is manufactured with a sufficiently small tolerance, a structurally very simple configuration results.

Other attractive embodiments are specified in the remaining sub-claims.

The present invention will be elucidated hereinbelow with reference to the annexed figures, in which:

figure 1 is a partly broken-away perspective view of a first embodiment of a device according to the present invention in a first position of the segments;

Figure 2 is a view corresponding to Figure 1 wherein the segments are situated in the second position;

Figure 3 shows a partly broken-away perspective view of a second embodiment of a device according to the present invention; and

figure 4 shows a view corresponding to Figure 3 wherein the segments are situated in the second position.

Figure 1 shows a mould which is designated as a whole with 1. The lower mould is formed by a base plate 2, an intermediate plate 3 and a top plate 4. A large number of segments 5 is arranged between top plate 4 and intermediate plate 3. Segments 5 are herein grouped around cavity 6.

In the present embodiment five segments are arranged around each cavity 6. The cavities correspond with relevant holes 7 arranged in top plate 4. Intermediate plate 3 and top plate 4 are mutually connected by connecting elements 8. Connecting elements 8 are placed such that they do not obstruct the movements of segments 5.

Channels 9 are arranged in segments 5 in order to drive segments 5 between the first position shown in figure 1, in which the forming of the product can take place, and the position shown in figure 2 in which the product can be released from the moulds. Extending in the channels are pins 10, which are drawn in the present case with a rectangular cross-section but which may equally be embodied round, for instance with the shape of a circular cylinder. Essential here is that they fit precisely into channels 9.

The pins 10 are all connected to a cylinder 11. Each of the cylinders 11 is connected to base plate 2. By

moving base plate 2 up or downward, the segments are therefore moved between their first position, shown in Figure 1, and second position, shown in Figure 2.

It will be apparent that it is possible to employ other forms of drive, for instance an individual drive element instead of each of the cylinders 11. It is also possible to make use of other types of drive element, for instance lever systems or of systems provided with profiled cam discs.

It will of course be apparent that a form of drive must be chosen which fits into the limited space available.

This embodiment also has ejector elements. The ejector elements are formed by stamps 12 which are provided on their underside with a pin 13, wherein a spring 14 is arranged between the underside of pin 13 and base plate 2. When plate 2 is moved upward in order to carry segments 5 from the first position to the second, release position, spring 14 will be compressed, whereafter stamp 12 will press out the product when the release position is reached.

This latter measure is however not specifically necessary for applying of the present invention, it merely forms an attractive additional measure.

Figure 2 shows how segments 5 are situated in their release position; protruding edges of the formed product do not represent problems here, thus resulting in a greater freedom in the design of products to be manufactured by this device.

It is noted herein that in the present embodiment there is a division into four segments. It is of course possible to make use of other numbers of segments. In order to keep the drive as simple as possible, the aim will be a small number of segments, thus for instance two. In many cases, however, sufficient freedom is not obtained herewith for release of the formed products. Four is found to be an attractive number of segments.

As shown in figures 3 and 4, it is also possible to make use of a much larger number of segments. Use is made herein of a certain form of circle symmetry, so that despite the large number of segments use can be made of a simple drive. Figure 3 thus shows a top plate 4 in which a hole 7 is arranged, below which a cavity 6 is situated. Cavity 6 is enclosed by twelve segments 15 which are conical on their outside. These are enclosed by a ring 16 which is conical on its inner side. Ring 16 is movable in vertical direction, whereby segments 15 are moved toward each other into the position shown in figure 3.

When ring 16 is then moved downward as shown in figure 4, segments 16 are able to move outward. In the embodiment shown in Figures 3 and 4 the outward movement is achieved in that the segments are also provided on their inner side with a conical edge which is urged outward by a conical body 17 when this conical body 17 moves upward. It is of course a prerequisite here that the movements of conical body 17 and ring 16 are synchronized. Conical body 17 is further provided on its top with a stamp 18 for pressing out the finished product 19.

It will be apparent that other constructions can also be applied in the case of a large number of segments 15, for instance a construction wherein each of the segments 15 is urged inward or outward by means of a spring, and wherein the urging force in question is counteracted by a movement of a body.

The number of segments can of course also be greatly changed.

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